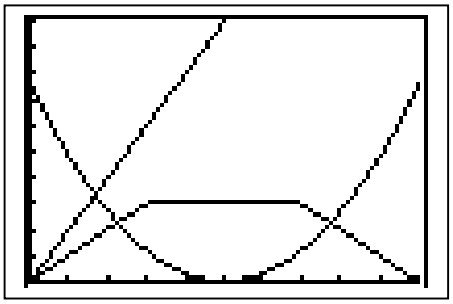
Activity #14: Math (Teacher version)
Technology: Lines, Parabolas, and More



***Note to students*: Lab teams of two or three students are required for this activity.**

National Standards addressed:
Content Standards:
Algebra Expectations: Students will represent and analyze mathematical situations and structures using algebraic symbols; students will analyze change in various contexts; students will draw reasonable conclusions about a situation being modeled.
Measurement Expectation: Students will make decisions about units and scales that are appropriate for problem situations involving measurement.
Process Standards:
Problem Solving Expectations: Students will monitor and reflect on the process of mathematical problem solving; students will apply and adapt a variety of appropriate strategies to solve problems.
Communication Expectations: Students will organize and consolidate their mathematical thinking through communication; students will communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

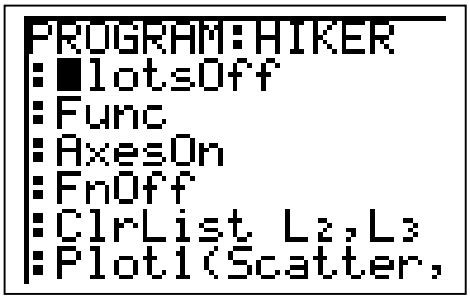
***Purpose*:** **To begin to understand the programs that make our technology tools so powerful**
To investigate change over time
To model change as linear and quadratric functions

***Materials*: TI graphing calculator, TI-CBL and motion detector (Vernier probe) or TI-CBR, HIKER program for TI graphing calculator, TI-Graph Link, TI overhead grapher and view screen (optional)**

***Activity Procedure*:**
Part One:
Enter the following TI program in your calculator. Have your partner "proofread" your entry and then correct any typing errors.

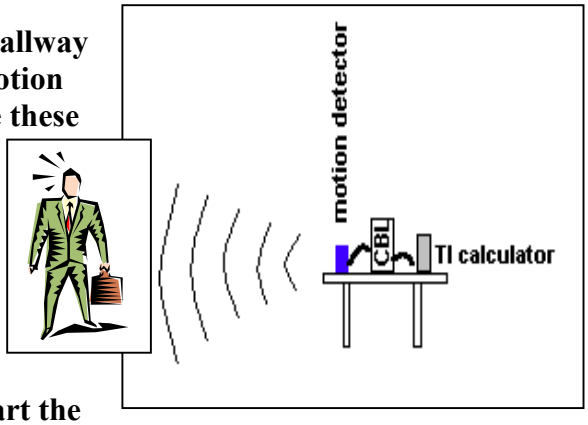
PROGRAM: HIKER (Published in the Texas Instruments CBL Workbook ©1994)

```
:PlotsOff
:Func
:AxesOn
:FnOff
:ClrList L2, L3
:Plot1(Scatter,L2,L3,•)
:0→Xmin
:6→Xmax
:.1→Xscl
:0→Ymin
:20→Ymax
:1→Yscl
:60→dim L2
:60→dim L3
:seq(I,I,.1,6,.1)→L2
:{1,0}→L1
Send(L1)
:{1,11,3}→L1
:Send(L1)
:ClrHome
:Disp "PRESS ENTER"
Disp "TO START"
:Disp "GRAPH"
:Pause
:ClrDraw
:Text(51,78,"TIME")
:{3,.1,-1,0}→L1
:Send(L1)
:For(I,1,60,1)
:Get(L3(I))
:Pt-On(L2(I),L3(I))
:End
:Stop
```



Part Two:

Set up equipment by clearing a path; using a hallway in school works well. Connect the CBL, the motion detector and the TI graphing calculator. Place these on a desk with the motion detector facing the student who will walk the desired curve. The motion detector collects data points every 0.1 seconds for 6 seconds, measuring the distance from the CBL in feet. It detects motion as close as 1.5 ft.



To generate curves, turn on all equipment. Start the program "HIKER". The program pauses at "PRESS ENTER TO START GRAPH". When the equipment and the walker are set to go, press Enter on the calculator to begin data collection as the walker begins to walk.
A graph of time vs. distance is displayed and data points can be traced.

Part Three:

1. Walk a straight line with a positive slope. Print this graph using TI Graphlink. TRACE along the line and write down the coordinates of two points.

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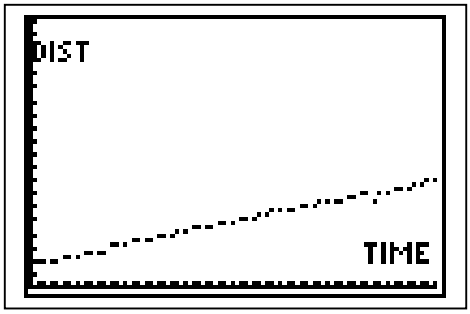

a. Find algebraically the linear equation that models the graph. Show all work.
(Using (.1, 1.81735) and (2, 3.84058) , the slope = m = 1.065. The equation is y = 1.065x + 1.711)

b. Perform a linear regression on the data collected. Remember that data for time, the x-variable, is stored in L_2 and data for distance, the y-variable, is stored in L_3. Write the linear regression. _____
How does this calculator generated linear equation compare to the equation you found in part a? _____
_____
_____
_____

Put this equation in y_1 and graph again. This time both the scatter plot and the function, y_1, will be graphed. Print this graph.

c. At what speed were you walking? Is this the same as your velocity? Why or why not? _____

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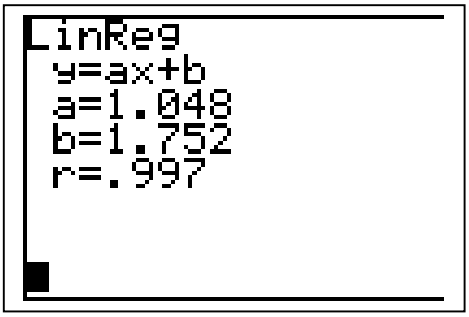
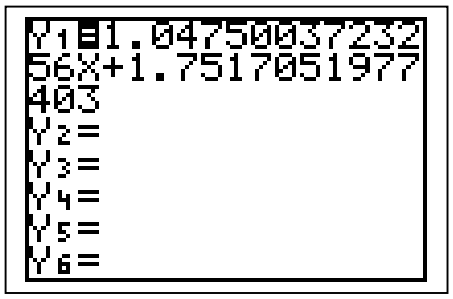
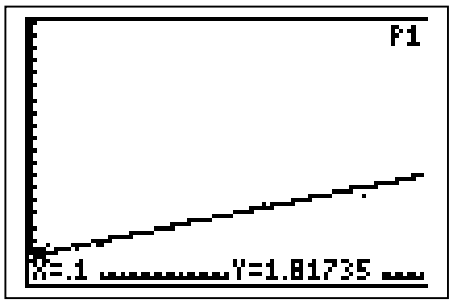
(An example is shown below. Your speed would be 1.048 feet per second. In this example it would be the same as your velocity.





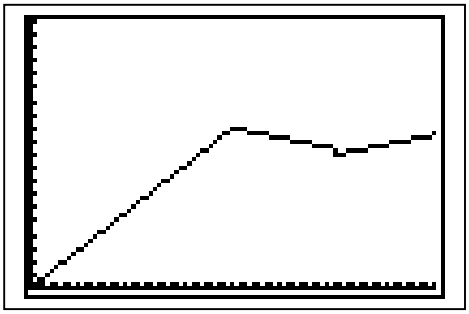


2. Repeat the previous step for each of the following and find the equations that model each, using any valid method (Show all work. Print appropriate LCD displays using TI Graphlink.):

1. **walk a line with a negative slope**
2. **walk a graph to model the absolute value**
3. **walk a curve that models a parabola that opens down**

3. Try to walk the graph given by the piecewise function,

$$f(x) = \begin{cases} 4x, & 0 \le x \le 3 \\ -x + 1, & 3 < x \le 4.5 \\ x + 5.5, & 4.5 < x \le 6. \end{cases}$$



Describe your motion. Print a copy of the graph of the given function and the graph of your walk. _____

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3. Create a box and whisker plot using the TI graphing calculator. Find mean from plot. Print the plot using the TI Graphlink.
(Walk away from the motion detector for 3 seconds; walk slower toward the motion detector for 1.5 seconds; finally, walk at about the same speed as the second part away from the motion detector for 1.5 seconds.)

Analysis:
Write a one-page paper describing the mathematics you learned and used in this activity. Describe how this activity helped you understand math better.

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The following web sites and articles provide enrichment and support for this activity:

1. EXPERIMENT M1: Take a Hike, CBL™ System Experiment Workbook, by Texas Instruments ©1994.
2. http://education.ti.com
3. http://www.askeric.org/Virtual/Lessons/Mathematics/Statistics/STA0002.html
4. http://www.nsa.gov/programs/mepp/hs/alg01.pdf
5. ADVANCED ALGEBRA, by Bellman, Bragg, Chapin, Gardella, Hall, Handlin, Sr., Manfre, Prentice Hall ©1998